himself created the most important of the newer departments of mathematics.

By the introduction of his concept of continuous groups of transformations he put the isolated integration theories of former mathematicians upon a common basis. The masterly reach of Lie's genius is illustrated by his encompassment of the fundamentally important theory of differential invariants associated with the English names Cayley, Cockle, Sylvester, Forsyth.

Thirteen years ago Sylvester announced his conception of 'Reciprocants,' a body of differential invariants not for a group, but for a mere interchange of variables. A number of Englishmen thereupon took up investigations about orthogonal, linear and projective groups, groups in whose transformations interchanges of variables occur as particular cases, and whose differential invariants are consequently classes of reciprocants, and of the analogues of reciprocants, when more variables than two are considered.

Now all these investigations were long subsequent to Lie's consideration of the groups in question as leading cases of a general conception. Thus they were merely secondary investigations!

Again, the theory of complex numbers appears as a part of the great 'Theorie der Transformationsgruppen.' Indeed, this continent of 'transformations' opened up and penetrated with such giant steps by Lie represents the most remarkable advance which mathematics in all its entirety has made in this latter part of the century.

Sophus Lie it was who made prominent the importance of the notion of group, and gave the present form to the theory of continuous groups. This idea, like a brilliant dye, has now so permeated the whole fabric of mathematics that Poincaré actually finds that in Euclid 'the idea of the group was potentially pre-existent,' and that he had 'some obscure instinct for it, without reaching a distinct notion of it.' Thus the last shall be first, and the first last.

In personal character Lie was our ideal of a genius, approachable, outspoken, unconventional, yet at times fierce, intractable. His work is cut short; his influence, his fame, will broaden, will tower from day to day.

George Bruce Halsted.

Austin, Texas.

SCIENTIFIC BOOKS.

Colour in Nature: A Study in Biology. By Marion J. Newbigin. London, John Murray. 1898. Pp. 344.

On page 300 of this work we read: "We have now completed our general survey of the colours and colouring-matters of organisms. * * * That the survey as a whole is halting and incomplete must be obvious to all. We have seen that it is as yet impossible to classify pigments in a logical manner; that most of the problems connected with the subject are entirely unsolved." These statements are indeed true; and yet the book is an interesting and valuable one, and will be of real assistance to the working biologist.

The whole subject of color in animals and plants has suffered from the fact that it concerns the chemist and physicist as well as the biologist, and in these days of intense specialization it is hard to find anyone competent to treat the matter in all its aspects. Dr. Newbigin has endeavored, with some success, to take all the more important facts into consideration; but it is practically impossible for any one individual to have that intimate acquaintance with the vital phenomena of every group of living organisms which is necessary for a satisfactory discussion of their coloration. It was Darwin's method to seek the assistance of numerous specialists in different branches, who supplied him with information which he brought together and interpreted in a masterly manner. It may be that Dr. Newbigin has not yet felt justified in asking for such help, but now that she has fairly won her spurs (if one may use such a phrase in regard to a lady) it is not unreasonable to hope that she will adopt the Darwinian system, and eventually provide us

with an account of animal and plant coloration which will cover the ground as completely as the knowledge of the day permits. In the meanwhile, we may be grateful to her for a work which will at any rate serve as an excellent introduction to the subject, and as more or less of a revelation to those whose studies have been confined to a limited field.

Attention is drawn to the interesting analogy between natural color-variations of organisms and the changes which can be induced in their pigments by suitable reagents. This is a matter which, though well known, has not received the attention it deserves, partly because those aware of the chemical reactions have not usually been familiar with the natural variations, and *vice versa*. It may be permissible, by way of illustration, to cite two new instances of this among the Coccidæ which have just come to the writer's notice. *Icerya rileyi* has a pure white ovisac, which is turned bright primrose yellow by chloroform, but regains its white color when the chloroform evaporates. A closely related form, *Icerya littoralis*, var. *mimosæ*, has the whole ovisac naturally of a delicate primrose yellow. The second case is more instructive. *Mytilaspis concolor* has ordinarily a white scale, but on February 5, 1899, Mr. P. J. Parrott discovered a variety (*M. concolor* var. *viridissima*, Ckll. and Parrott, ined.) in which the scales of both sexes are of a lively emerald green. This was on the campus of the Agricultural College, Mesilla Park, at the bases of stems of *Atriplex canescens*. The female insect itself, removed from beneath the scale, was found to be of a dark purple color, with a bright yellow patch in the anal region, and suffused crimson spots at intervals round the margins of the hind end. The purple color, when the insect was placed in caustic soda, *immediately became green*, but was changed back to purple by acetic acid. Now, it is evident in this case that the insect must have had an acid reaction, but the pigment transferred to the scale had apparently been turned green by the 'alkali' salts which are known to occur in the soil at Mesilla Park. This at once recalls the chætopterin pigments described by Dr. Newbigin on pp. 89–91 of her work, and it may be that we have a new member of that series.

On pp. 161–162 it is suggested that the resemblance between certain Heliconian butterflies and their Pierid mimics may be due, at least in part, to their relatively low organization and simple plan of coloration. In the Transactions of the Entomological Society of London, 1891, Mr. H. H. Druce published a paper on the Lycænid genus *Hypochrysops*, which inhabits Australia and the Malay Archipelago. To this paper are appended two beautiful colored plates, and the present writer was surprised to find that he could nearly match a number of very diverse species figured, as to color and pattern, among a series of Lycænidæ collected in Jamaica! The resemblance pertained only to the upper surface of the wings, the lower surfaces of the Jamaican insects being quite unlike *Hypochrysops*. Now the Lycænidæ show splendid 'optical' colors, and are certainly not simply organized as regards their coloration, so the suggestion made with regard to the Heliconians and Pierids would not hold. Neither, of course, is there any true mimicry, since the two sets of butterflies occur on opposite sides of the world. Cases of this sort have been quoted as destructive to the theory of the utility of mimicry among insects, but to the writer they seem only to remove the difficulty which was felt in accounting for the origin of genuinely mimetic resemblances.

In a work of the kind now under review there must necessarily be details which could be adversely criticised. The writer had begun to take note of such, but it hardly seems worth while to dwell upon them. Botanists will undoubtedly complain that the space devoted to the colors of plants is much too short, and that several of the statements therein are too general or too sweeping. It will probably be thought by many readers that if Dr. Newbigin had made more or closer observations of living animals she would have had greater respect for natural selection. And, finally, some will wonder how it is that one who has enjoyed the beautifully pure colors of living creatures can have permitted her book to be bound in such a muddy and unpleasing blue.

T. D. A. COCKERELL.

MESILLA PARK, NEW MEXICO,
February 27, 1899.